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## SUMMARY

The King County Department of Natural Resources operates and maintains three wastewater treatment plants and one combined sewer overflow treatment plant that discharge treated effluent into the central Puget Sound basin. One of King County's responsibilities is to conduct monitoring in marine waters to ensure that these discharges are not degrading water quality within the vicinity of the treatment plants. The marine monitoring program has two components; point source monitoring which focuses on areas near treatment plant discharges and ambient monitoring which focuses on areas outside the immediate vicinity of known discharges. It is important to monitor areas outside the influence of point source discharges in order to assess background conditions in central Puget Sound.

In 1997, 15 subtidal (offshore) and 3 intertidal (nearshore) sediment sites, 5 subtidal and 6 intertidal water sites, and 3 shellfish and macroalgae sites were sampled for the point source program. For the ambient program, 3 intertidal sediment sites, 5 subtidal and 15 intertidal water sites, and 4 shellfish sites were sampled. Sediments were analyzed for organic compounds, metals, and conventional parameters and intertidal samples were also analyzed for bacteria. Water was analyzed for bacteria, nutrients, dissolved oxygen, chlorophyll, and physical parameters. Shellfish samples were analyzed for organics, metals, and bacteria. Macroalgae were analyzed for metals only.

## MONITORING RESULTS

### Water Column

Most dissolved oxygen values were below 7.0 mg/L from October to November and may be attributed to the input of deep oceanic water which naturally contains low amounts of oxygen. All but two values were above 5.0 mg/L, the level at which potential problems occur. Overall, dissolved oxygen concentrations in 1997 were slightly lower than in previous years, which may be an effect of the 1997 El Niño event and resulting warmer

water temperatures. Most ammonium concentrations were below the method detection limit except in the summer months. The highest concentrations were detected at the two wastewater treatment plant outfalls indicating the effluent plume was discernible. Nitrate and nitrite, important nutrients for phytoplankton growth, were most abundant in the winter when it was not taken up by phytoplankton.

All subtidal stations met the Washington State Class AA marine surface water standards for fecal coliform bacteria with the exception of the Denny Way station in inner Elliott Bay. The level at this station met the peak standard but was just above the geometric mean standard. Fecal coliform bacteria near treatment plant discharges were found at low levels if detected at all.

Fecal coliform counts at intertidal beaches are influenced by freshwater runoff from the surrounding watersheds. As a result, the number of stations exceeding the Class AA marine standards increased in the high rainfall winter months and at stations closer to streams and other sources of freshwater runoff. Several beaches, including the two West Point stations, met the geometric mean standard but failed the peak standard. Several beaches which have consistently failed Class AA standards over the years, also failed both standards in 1997. These stations are either near a freshwater source or in areas with poor flushing.

## **Sediment**

A total of 15 point source stations were sampled for total organic carbon, total sulfides, oil and grease, grain size, metals, organotins, and organic compounds. Six intertidal sites (3 ambient and 3 point source) were sampled for conventionals, metals, organic compounds, and bacteria.

Several metals were either not detected (antimony, cadmium, selenium and thallium) or were infrequently detected (silver). Arsenic, chromium, copper, lead, and zinc were detected in all samples, however, no metal concentrations exceeded Washington State Sediment Quality Standards (SQS). Nickel was also detected in all samples but no SQS exists

for this metal. Mercury was detected in most subtidal samples at concentrations below the SQS.

Of the 97 organic compounds analyzed, 18 were above method detection limits in subtidal samples and 7 were above detection limits in intertidal samples. Most of these compounds were polynuclear aromatic hydrocarbons (PAHs). Sediment sampling generally showed the highest levels of organic compounds in the nearshore areas of Elliott Bay, where urban runoff from storm drains, industrial sources, and nonpoint sources is the greatest. Hexachlorobenzene exceeded the SQS at three of the Renton outfall stations even though this compound had not been detected previously at this site. No other detected compounds exceeded standards. Organotins were detected at the Renton outfall and Denny Way stations but not the Alki Point outfall stations. The highest concentration was found at the Denny Way site in inner Elliott Bay. High concentrations of organotins, particularly tributyltin, have been detected in inner Elliott Bay where tributyltin is used on large ships as an anti-fouling agent.

## **Shellfish**

Shellfish samples were analyzed for metals, organic compounds, and bacteria at two point source stations and for bacteria at seven stations. Only four organic compounds were detected in shellfish tissues: benzoic acid, benzyl alcohol, 2-methylphenol, and pyrene.

Eight metals were detected in shellfish tissues, which is consistent with results from previous years. State and federal criteria do not exist for acceptable levels of metals in shellfish tissues, however, the Food and Drug Administration (FDA) has established an Action Level in fish and shellfish tissues of 1.0 mg/kg for mercury. When this value is exceeded, the food product cannot be commercially traded. Mercury concentrations in shellfish were well below this Action Level. The FDA has also established guidance values termed Levels of Concern for mollusks for five metals: arsenic, cadmium, chromium, lead, and nickel. Shellfish results were below these Levels of Concern.

Fecal coliform concentrations varied from station to station and from month to month. The highest fecal coliform bacteria counts tended to be in

September and during the summer months when increased feeding occurs due to optimal growing conditions. There did not appear to be a relationship between fecal coliform concentrations in shellfish and concentrations detected in the water column.

## **Macroalgae**

Four stations (3 point source and 1 ambient) were sampled for metals. Seven metals were frequently detected: arsenic, cadmium, chromium, copper, lead, nickel, and zinc. The station located just south of the Coast Guard lighthouse at West Point had the highest concentrations for most metals, which is the pattern observed from previous sampling. The station just north of the lighthouse also had higher metal concentrations relative to the concentrations detected in the Alki and Magnolia samples.